

**Library Service Innovations :
The National Library Board of Singapore's Journey**

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Abstract :

Public Libraries in Singapore have existed for over 50 years with the largest number of service innovations happening in the past 20 years. In the early years, libraries were manually managed as technology was not so easily available and it was costly to apply information technology to libraries. However, in the past 20 years, prices of technology came down and use of personal computers, laptops and handheld devices became much more prevalent, especially with the ease of accessing internet. One of my colleagues told me this : when she travels on the train, she notices that almost everyone is engaging with their mobile phones. She commented that if everyone was studying so hard using their mobile phones, they would all get 100 marks in their examinations.

Yes, now that almost everyone has access to internet and the mobile phone, libraries need to keep up with the changing lifestyles of users. Public Libraries in Singapore are no exceptions. They have to continuously innovate to provide services that meet the needs of users, and in a manner that users prefer to use the service. In the past ten years, the National Library Board of Singapore has been actively digitising materials and using social media to reach out to the public and end users so that they can access library materials more easily through their handheld devices at any time of the day or night. This paper describes some of these developments and provides ideas on the future directions of libraries in ensuring that libraries remain relevant to the lives of the people they serve, and that they are central to the life-long learning journey of end users.

Background

The National Library Board of Singapore (NLB) is a statutory board belonging to the Ministry of Communications and Information. It has a short history, starting from the early days when the National Library was set up in 1960. Over the past 55 years, the National Library

set up a system of 26 public libraries to serve users who live in housing estates, each with a population of between 100,000 and 300,000. Today, the NLB runs the National Library, the National Archives, 26 public libraries and 9 special libraries. It also provides fee-based services to clients locally and overseas through its commercial arm called the Cybrarian Ventures Private Limited.

From physical to digital access

The journey of the NLB from physical to digital access to content is probably similar to most other libraries in the world today. With the increasing ease of access to internet and the high ownership of mobile devices, users have been pushing libraries to provide more convenient library services through digital channels.

Gone are the days when the library user has to visit libraries to obtain the information that he needs. He now has a choice to either visit the library to obtain the materials or he can search the internet for the information. If the library does not appear in his search for information, the library's materials will not be used as much as desired.

It is with this in mind that the NLB launched an active programme to move its library services from a purely physical service to a hybrid physical and digital library service. Today the NLB enjoys a high level of use for both its physical and digital resources, thanks to the internet and open source software that allows the NLB to not only allow users to access its content through its website, but also through internet search engines.

Physical loans grew from 10 million in 1995 to 33.2 million in 2014. The number of digital visits was 13.5 million in 2014, and e-retrievals recorded a high of 52.8 million in the same year.

Book borrowing : the early days

Like most other libraries, up to the 1990s, most library operations were very manual. Book stores were not common, and even if one has access to them, books are costly to most people. Library users had to physically make a visit to the library to enjoy the library's

collections and services. It was not very easy to get to a library as there were not many libraries. I still recall going to the National Library only during the school holidays as the library was 10 km away from our house and it was always an outing that we treasured.

As library operations were largely manual, users usually had to queue to be served by library staff. From a system of one National Library to a system of 10 libraries from 1960 to 1994, the National Library saw healthy growth. Queues were becoming longer each day and users were unhappy that they had to queue for hours sometimes to borrow and return their books. Those were rather unhappy times for both library staff and library users.

By 1995, the National Library had become a statutory board, and it had the opportunity to submit a blue-print to the government to invest in infrastructure, collections and services to significantly improve the user experience for library users. A S\$1 billion budget was approved by the Singapore Government for the NLB to revamp, expand and improve its services. With this budget, the NLB upgraded its 10 existing public libraries, and set up another 10 public libraries. Most of these were either located in the shopping malls where Singaporeans visit during their leisure times, or co-located with other community or civic institutions. Collections and services were also upgraded and innovative ways of designing services and re-designing processes were prototyped and adopted.

Book borrowing transformation

Book borrowing was one of the most popular activities in libraries, then and now. From a manual system of using library transaction cards to facilitate book borrowing, NLB began actively looking into automated services to reduce queuing time.

NLB started trying out with self-service borrowing using 3M self-check machines. This was a good productivity tool as users and staff need not wait for each other for users to borrow what they wish to read. The only challenge that users faced is that they had to learn to hold the book in a certain direction when they are at the borrowing machines so that the light sensor reads the barcode on the book properly.

Though this sounded simple, it was not. Many users had difficulty learning how to hold the book and sometimes had to try more than once to ensure that the barcode of the book was read and the book was successfully borrowed via the self-service machines.

Also, the 3M self-check machines could not do book returning in a convenient manner. NLB decided that it would move on to using radio frequency identification tags (RFID) to facilitate borrowing and returning of library items, as the transaction for RFID tags would not require physical alignment of the barcode to the sensor.

Fortunately, for NLB, a local vendor was prepared to develop this service with NLB and the RFID self-check borrowing and returning services were developed and prototyped at the NLB's then newest library in 1998 in Bukit Batok. Despite initial challenges faced by both staff and library users, the project proved to be a success after one year. Both staff and users find the service easy to use and queuing time was reduced from 90 to zero minutes for both borrowing and returning of library materials. This was a significant achievement for NLB. Following the prototype, and fine-tuning of the service, the RFID solution was rolled out to all of the NLB's other public libraries.

Using mobile phones to borrow books : further book borrowing innovation

The self-service book borrowing service was a huge success in increasing the productivity of the NLB service. It also made the library user experience a much more enjoyable one, as users did not have to queue to borrow or to return books. They could spend most of their time reading and learning when they visit libraries.

With this achieved, NLB started looking at the next version of the book borrowing experience.

Around 5 years ago, the use of both the internet and mobile device was increasing by leaps and bounds. Almost every Singapore had a mobile phone in their pocket. NLB started looking at the possibility of enabling library users to borrow books using their mobile phone. This was successfully developed and was deployed in the NLB libraries in 2014. Today, after selecting their library materials, library users need not look for the self-service book

borrowing machines to borrow these materials. They can just take out their mobile phones and borrow the books wherever they are in the library.

To enable this to happen, library users need to download the NLB Mobile app from any app store and after registering themselves as members, they can start using the service.

App in Google PLAY / Apple app stores



NLB Mobile app



To Check-out an Item, scan barcode

Personalised recommendations



Multiple user profiles (family)

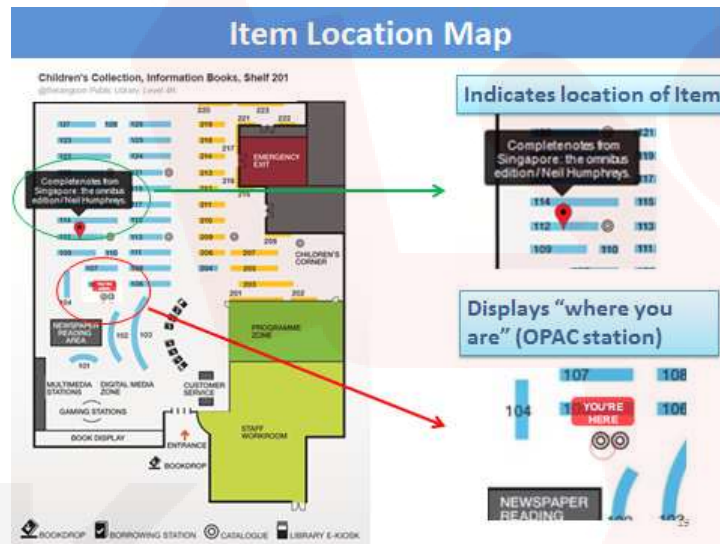
Received the American Library Association (ALA) Presidential Citation for Innovation International Library Projects 2015

Physical library innovations

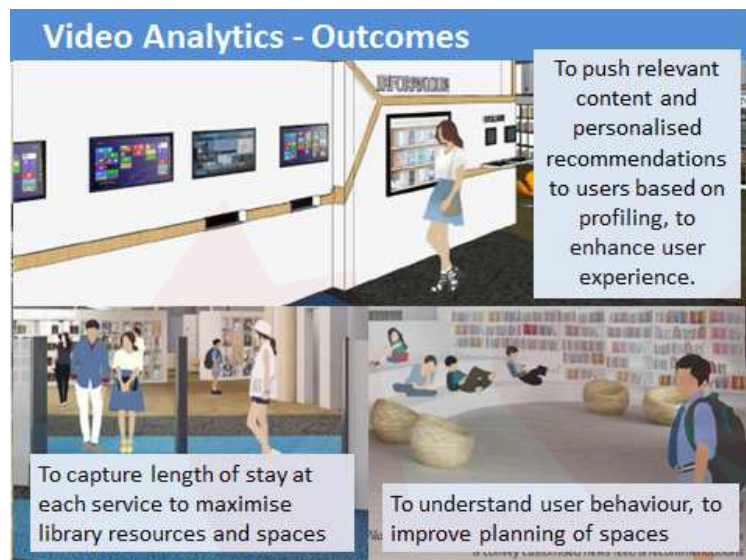
In this section, I will discuss the innovations in digital library signage, online library item locator, use of video analytics and a proof-of-concept (POC) of a shelf-reading robot.

Digital library signage : with the pervasiveness of digital platforms, the NLB is now providing dynamic information about the library using digital signage in the library. This allows the library to decide on what will be promoted each day to the users visiting the library. The service improves productivity and also enables the library to provide more up-to-date information about the library. Changes to the information can be made more often and information can be provided in more visual ways.

Online library item locator : the online library locator allows the library to help the user find materials that he needs in a shorter time. When a library user searches for a library item, the user can look at the map of the library online immediately to determine the location of the library item.



Video analytics : in all libraries, the library management is always keen to find out who is using what services and how many people are using each of the library's services. Getting this information will allow the library to plan more accurately the type of services that better meet the needs of its users. In its newest library in PasirRis, the NLB has installed video cameras to capture the profile of users dynamically everyday. The data that is collected by this equipment can be analysed by the library team regularly to determine which of the services are well-used and which are less well-used at different hours of the day or different days of the week. It is also possible to find out the categories of users of each service by looking at the approximate ages of the users that use each service.



Shelf-reading robot : the shelf-reading robot trial provides NLB an opportunity to digitally shelf-read all the books on the shelves overnight in one library to find out if the books are properly shelved, and whether books from this or other libraries are mis-shelved in the library. If this task is to be done by a team of staff, it will take a very long time to do a visual check of all the books that are shelved. It is also difficult to locate books that belong to other libraries unless each book is opened to be checked visually. In the trial, the robot does the work during the night after library opening hours, and produces a list of books that are either mis-shelved or which belong to other libraries. Library staff can then locate books that are mis-shelved so that they can be shelved in their correct locations for easy locating by users.

Library planning and operations innovations

library@orchard :library@orchard was set up as library for users between the age of 18 and 35 who did not use libraries regularly as many work in town and find it hard to visit the NLB's public libraries that are located in housing estates. If you have visited Singapore, you would know that Orchard Road is the main shopping street in Singapore, lined with large shopping malls along the whole street.

The current library@orchard is the second library to be set up in Orchard Road and this was opened in late 2014. In the planning of this library, the NLB took a new approach in planning and designing the library by adopting the design thinking process. Design thinking is a process which puts the user at the centre of the design process, and it involves engaging the user in every phase of the planning process. As a result of this, library@orchard incorporates a number of ideas that users proposed for the library. These include interactive spaces for library programming, reading cocoons for individual reading spaces, and having magazines shelved with their covers facing out. Users are very happy with the design of this library.

library@chinatown, a full-fledged public library run mainly by volunteers :library@chinatown was set up in January 2013. In this instance, NLB was very fortunate that two sponsors were prepared to come up with funds to set up and operate the library for up to 10 years. It was an offer that NLB could not reject. To make the project even more exceptional, NLB decided to plan for a library that is fully run by volunteers. Once decided, work to recruit volunteers started very early during the planning process as it would require a long lead time for NLB to find and train enough volunteers who are willing to give their time to run this library. As it turned out, the plan was possible to implement. NLB was able to find volunteers who were willing to come and work in the library on their own free will, and this has kept the library going since. Of course there are challenges, however, these are not issues that could not be resolved.

Learning from the experience of library@chinatown, library@orchard also adopted the practice of engaging volunteers in running libraries and this has proven to be as successful. Volunteers are often very regular users of the NLB libraries.

Digital Library innovations

Here, I would like to discuss the digitisation of Singapore content to improve access, the development of OneSearch and eReads to make searching and selection of library materials easier, and the use of text analytics to push relevant content to users on the fly.

In the early days of the internet, the NLB was not certain about how to make use of the internet to push its digital resources to the general public. In 2005, when the NLB started offering its curated digital content to the public, it was done mainly through its corporate website. Usage was low, with about 400 accesses a month. This was for a database of over 1,000 articles written by librarians on and about Singapore, called Singapore Infopedia.

After internal reviews and learning from the industry, the library team decided that it had to learn more about search engine optimisation. This is so that the resources could be made more searchable when users search internet search engines such as Google and Yahoo. Staff were sent to courses that teach writing for the internet, and the IT team restructured the database so that it is not more than three layers deep. This attracted internet search engines to crawl and index the content in the NLB databases.

Bringing NLB resources to its users in a more intuitive and convenient manner




An online encyclopedia on Singapore's history, culture, people and events, curated by librarians

<http://eresources.nlb.gov.sg/infopedia/>

Search Engine Optimisation
Pageviews increased from 400 to 200,000 per month



Mobile Access
Accessible on all devices, including mobile phones



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These efforts helped increase access tremendously. Use of the content increased steadily and today, the Singapore Infopedia enjoys 3.4 million page views in 2014 alone. This is a 700-fold increase in the use of the content.

Mass digitisation

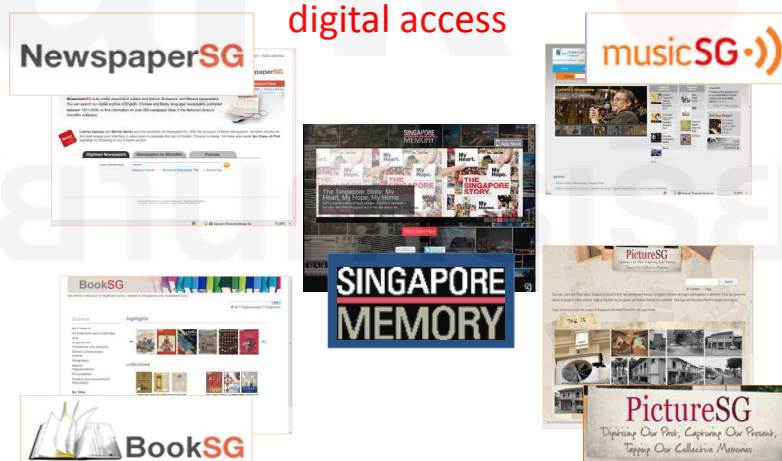
With the positive experience of Singapore Infopedia, the NLB took active steps to restructure all its websites into microsites. These included websites for digitised books, images and newspapers.

Mass digitisation of the Singapore newspapers started in 2007 when the NLB signed an agreement with the largest newspaper publisher in Singapore. This gave NLB the rights to provide remote access to all the newspapers owned by the company to users from the first issue of the newspaper published in 1845 to the issue dated 31 December 1989. For issues after this date, the library user will visit the NLB libraries to access them onsite.

Remote access to digitised newspapers was a great boost to researchers doing research on Singapore. Feedback was very positive, with one researcher indicating that the digitised newspaper service has revolutionised research on Singapore, as it is now so easy for them to access the newspapers from wherever they are, 24 by 7. Use of the newspaper increased dramatically. From a low base of 3000 users per month when the newspapers were accessible via microfilm, today, NewspaperSG enjoys a high usage of 12.88 million page views, or a 358-fold increase in 2014.

Today, more than 200 newspapers have been digitised and use of this rich resource is still growing.

The last 5 years saw concerted efforts in digitising valuable Singapore content for digital access



The same experience that the NLB had gained digitising valuable resources on Singapore and putting them out for users was applied to materials owned by the National Archives of Singapore (NAS) when they joined the NLB family from 1 November 2012.

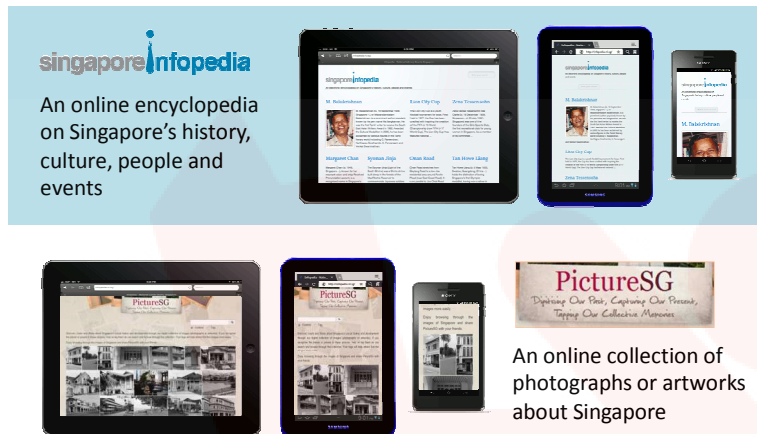
As the NLB had gained considerable experience in mass digitisation and in putting them into microsites for access, the NAS could draw on this experience and did not have to reinvent the wheel. Over the past year, the NAS digitised a large proportion of their publicly accessible content such as official speeches of government agencies, images and maps. These were also put out to internet search engines for them to crawl and index. Use of the content increased since the digitised content had been put out for search engine optimisation, from 0.5 million page views to over 3.7 million page views over 10 months, recording a large increase of 750%.

From laptops to tablets and mobile phones

The next development focused on moving content from computers and laptops to tablets and mobile phones as NLB users were fast moving their access gadgets from PCs and laptops to hand held devices.

NLB's innovation team developed a way to enable the content to be presented to the user in a multi-screen support manner. This ensures that the content is laid out in a way that makes use of the content easy to the eye. A responsive web design process is established and this helped the NLB roll out new content without having to redesign the web pages for smaller screens.

Multi-screen support: responsive web design



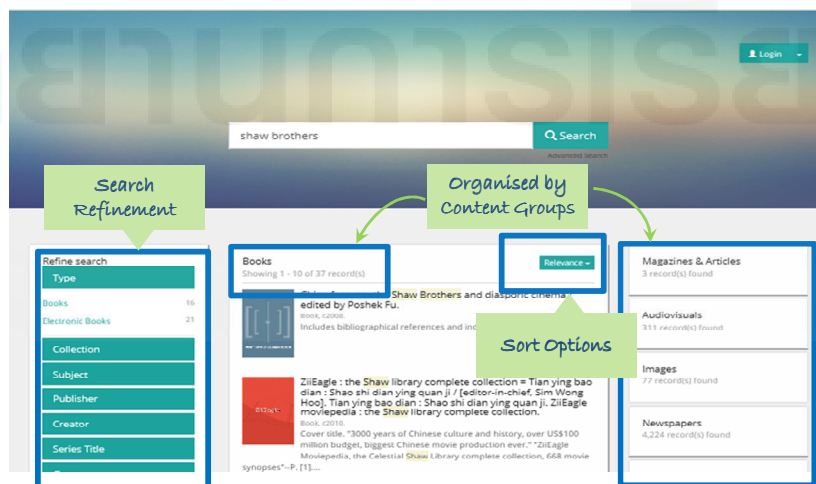
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Audio and videos were also streamed to the devices that the users hold in their hands. This allows NLB to reach the users in the way that they prefer, to access NLB's rich content.

OneSearch across all formats of resources

Having enabled content to be used on the various handheld devices, the NLB began earnest work to enable users to search across all its content databases, from books, to ebooks, to commercial databases and NLB's digitised books, newspapers, maps, audios, videos, images and manuscripts. This was completed and launched to the public in August 2014, making it a breeze for users to search across all of the NLB's physical and digital resources.

Enhanced integrated search experience



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eReads : an innovative collection display

In the last 10 years, NLB had moved into building its digital collections in a big way as it was clear that many users prefer to use the digital version of library materials as often as they can. With access to the digital version, users can access the library's collection anytime anywhere.

Over the years, NLB built on its ebooks, enewspapers and ejournals collections to better serve the needs of users, and to reach out to users who are not able to come to the libraries physically to enjoy the library's collections and services. Today, NLB has over 3.5 million ebooks that users can access round the clock.


In the physical world, it is not easy for the library to re-arrange its shelves in categories that users prefer to browse the collections, similar to the way book stores display their collections. The NLB currently arranges some of its physical collections in categories that are very popular with library users. These include subjects such as computer science, management, business, travel and health. However, in the physical world, it is hard to re-categorise these subjects often and move the books around as and when needed as the effort needed to re-arrange the books is tremendous.

In the digital world, the effort is much less once the software to enable this is developed. NLB has developed a service to allow librarians to re-arrange its collections in any categories that users are interested in, and this can happen as often as everyday or every week. The effort to effect the category changes is only half a day, and it is all done virtually. No physical work is needed in this re-arrangement.

Pushing out related resources to end-users

By this time, NLB found that in the market, there is open source software that allows NLB to convert every e-retrieval effort into an enriching discovery experience without the user having to do additional searching. The NLB experimented with Mahout, an open source software that pulls together related articles on a topic such as the war history of Singapore, using newspaper articles that have been digitised and which can be searched by the software easily.

Discover related content regardless of institutions, formats and languages




The Cenotaph, located at Esplanade Park along Connaught Drive, is a war memorial which commemorates the sacrifice of the men who during World War I and World War II. It was unveiled on 31 March 1922 by the Prince of Wales. On 28 December 2010, it was gazetted as a national monument together with two other structures in...

Lim Bo Seng (Article)
Major-General Lim Bo Seng (b. 27 April 1909, Nan Ann, Fujian, China - d. 29 June...

Dalhousie Obelisk (Article)
Dalhousie Obelisk, landmark, located at Empress Place in the Central Region. The tall...


Gwee Peng Kwee
His daily routine school...
Laying of foundation stone... and unveiling of Cenotaph...

Master Plan for Singapore - Central Area (1958)




Newspaper articles

Singapore's War Memorial to the Glorious Dead (11 Nov 1920)




Singapore's War Memorial (21 Sep 1921)




Arrival of the Prince (31 Mar 1922)


Rousing Reception At Johnston's Pier.



Lest we forget (8 Nov 1953)



Singapore students learn to care about history (13 Jul 1997)



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What's next?

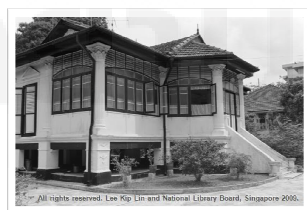
With the above efforts, it has become much easier for users to access NLB's content from wherever they are, with any device that they hold in their hands.

NLB is now working on how to make it possible for users to search content that is not searchable such as images without captions. One way is to match images that look alike. If they are about the same object, the metadata that is available for one image can be used for the other images on the same object.

What's Next?

Searching the 'unsearchable' – images without meta-data description

Example:
Images without meta-data description



Similar images via content analytics:



A 1982 photograph shows a single-story house built in Malay architectural style at no. 33 Scotts Road (property of Tan Yeok Nee family, now acquired).



A 1982 photograph depicting house no. 33 Scotts Road (property of Tan Yeok Nee family, now acquired). The road mentioned is located in the Orchard Road area.






This 1982 photograph shows house no. 40 Scotts Road. The road mentioned is located in the Orchard Road area.

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NLB is also working on facial recognition of prominent personalities, time stamping of videos and audios for easier search and find. Machine translation is another area that is being explored. This would be very useful for access to NLB collections that are currently in 4 languages, English, Chinese, Malay and Tamil.

What's Next? Searching the 'unsearchable' : other possibilities

<p>Facial recognition of key personalities</p>	<p>Audio/video (text and time-stamps)</p>	<p>Translation of words</p>
		<p>welcome 欢迎</p> <p>selamat datang</p> <p>நல்வரவு</p>
<p>Image processing</p>	<p>Voice-to-text</p>	<p>Machine translation</p>
		
	<p>OCR of text on video</p>	

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Finally, NLB is also keen to find a way for time-based and location-based information on street and building names to be auto-extracted to allow users to go back in time to learn more about these places.

What's Next? Automatic extraction of time-based and location-related information such as street and building names

- Time and location are two of the most fundamental ways we organise things
- The automatic extraction of geo- and time-based references from full-text content can yield more data than through manual tagging

Resources can be mapped for contextual discovery

Users navigate through old images of Singapore buildings, streets, satellite images and events via augmented reality apps



Resources are time-stamped for discovery on a time-line

12 Aug 1956 07 Sep 1971 30 Mar 1988 26 Jul 1992 16 Aug 2002 11 Feb 2009

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Conclusion

In conclusion, although NLB had taken a journey to innovate in all areas of library work, and to enable easier access and use of library resources for many years now, there is still much more to be done. We are very aware that it is only when we are able to collect, organise and make library materials accessible in a very convenient way, that current and future generations of users will continue to use libraries and library services in the years to come.

